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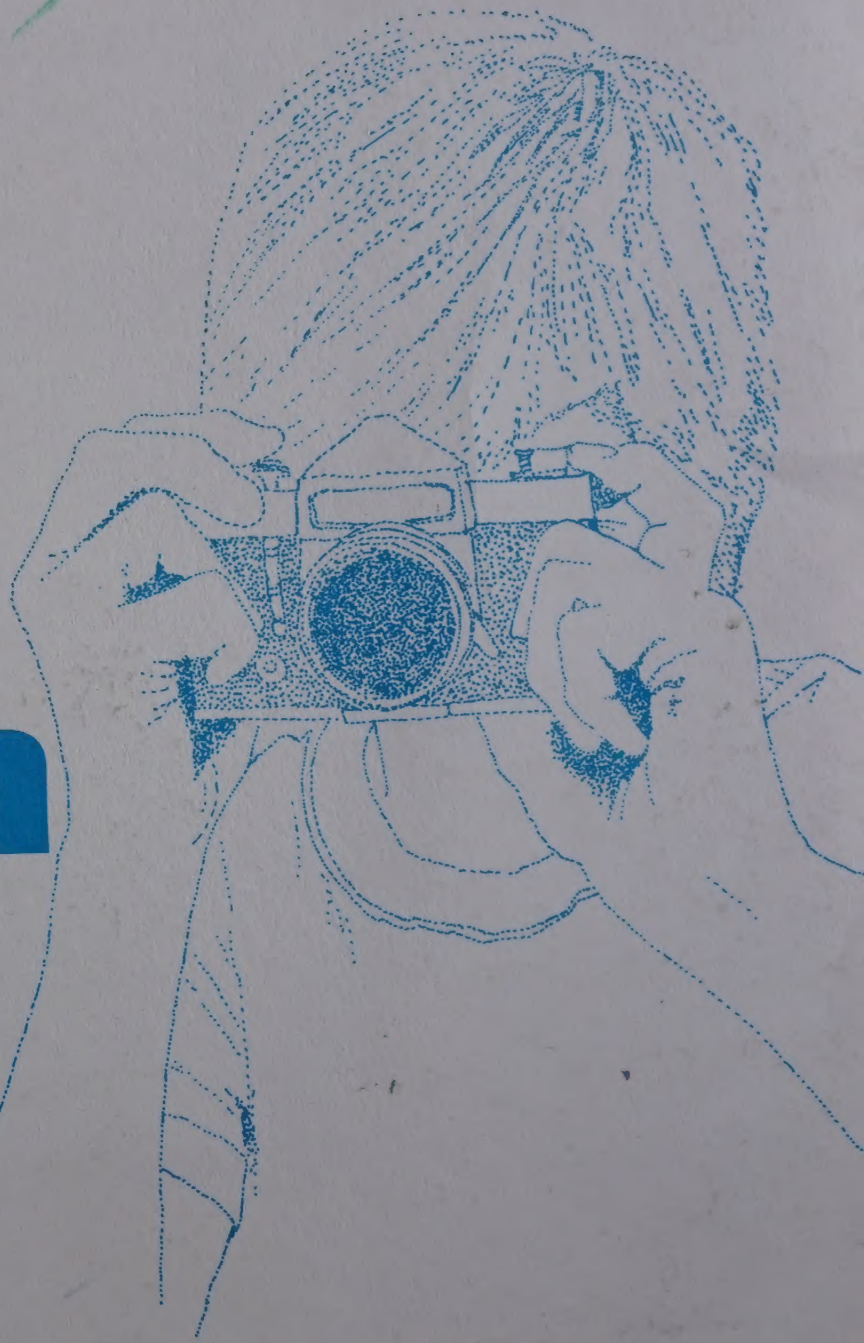
classroom cameras



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Introduction

This unit was developed for grade 8, 9, and 10 occupational students at the Junior Secondary School level. The approach is somewhat different from an ordinary instructional unit. An attempt has been made to take the special characteristics of occupational students into consideration. Teachers must be actively involved. The objective is to expose these students to a way of seeing, gathering information, and experimenting. The emphasis is to enable them to see relationships among different subjects such as science, art, language arts, social studies, and environmental studies through photography. Most important of all, we would like to develop a skill in communication that may be useful in their adult life.

Part or all of the unit may be useful for the elementary as well as regular programme junior secondary teachers. It can be implemented in general science with emphasis on science concepts or as part of the art programme with the emphasis on creativity. The craft of photography, when mastered, can also be very useful in social studies, or as part of the communicative skills programme in general.

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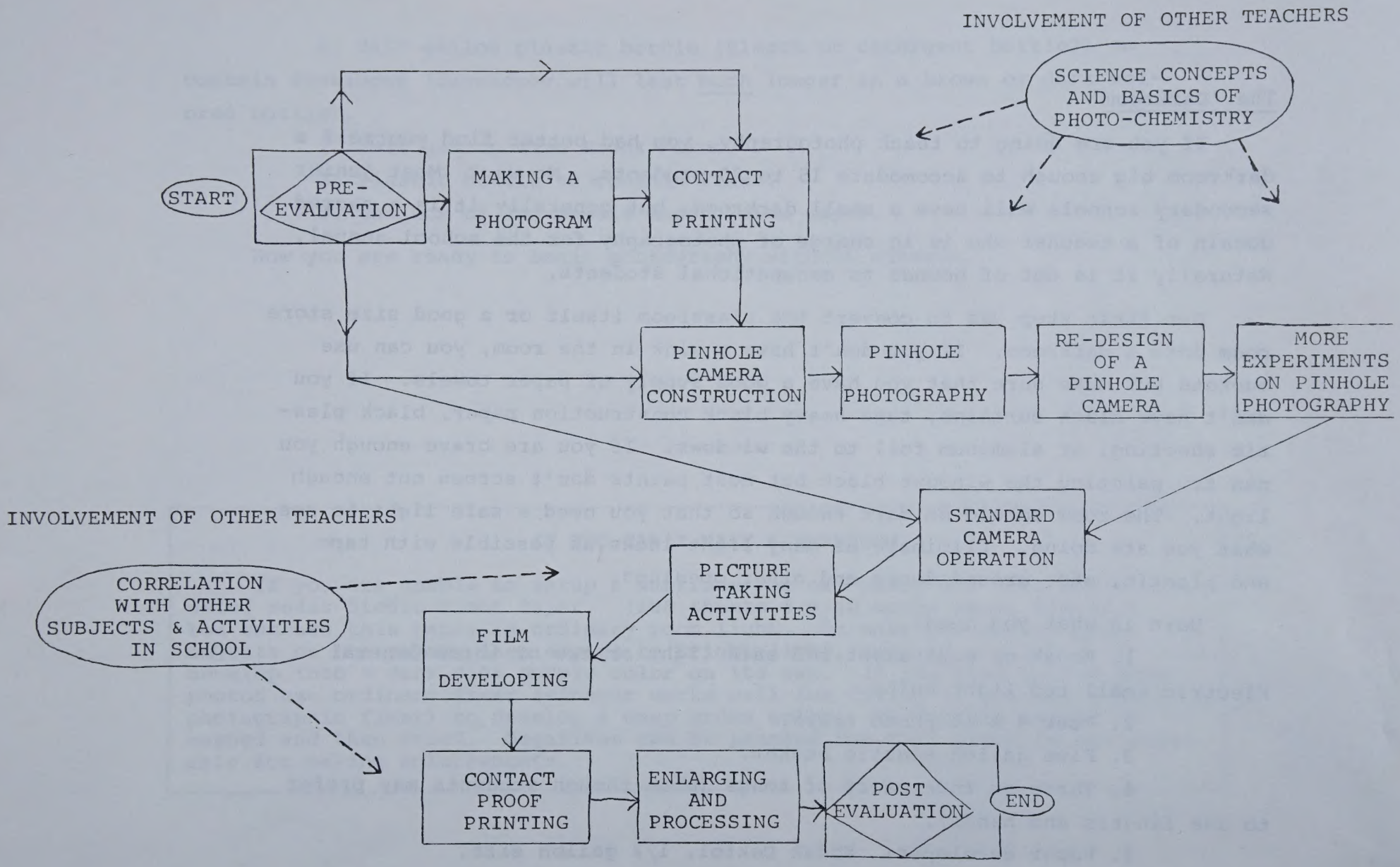
FLOW CHART OF ACTIVITIES



The 'Darkroom'

If you are going to teach photography, you had better find yourself a darkroom big enough to accomodate 15 to 30 students. No way? Most junior secondary schools will have a small darkroom, but generally it is a sacred domain of a teacher who is in charge of photography for the school annual. Naturally it is out of bounds to occupational students.

Our first step was to convert the classroom itself or a good size store room into a darkroom. If you don't have a sink in the room, you can use buckets but make sure that you have a good supply of paper towels. If you don't have black curtains, tape heavy black construction paper, black plastic sheeting, or aluminum foil to the windows. If you are brave enough you can try painting the windows black but most paints don't screen out enough light. The room should be dark enough so that you need a safe light to see what you are doing. Eliminate as many light leaks as possible with tape and plastic, etc. around doors and other openings.

Here is what you need:

1. Kodak or equivalent red safe light or two or three General Electric small red light bulbs.
2. Four 8 x 10 photo trays.
3. Five gallon plastic bucket.
4. Three or four pairs of tongs (even though students may prefer to use fingers and hands).
5. Paper developer: Kodak Dektol, 1/2 gallon size.

6. Half gallon plastic bottle (bleach or detergent bottle?) to contain developer (developer will last much longer in a brown or dark colored bottle).

7. Half gallon size Kodak Fixer.

8. Plastic bottle to contain fixer.

9. One box of 100 sheets Kodak Velox paper.

Now you are ready to begin photography without cameras.

IF YOU CAN'T MAKE A DARKROOM

If you are unable to setup a darkroom you can carry out some activities using Kodak Studio Proof Paper. (100 sheets 8 x 10 costs about $14.50.) You can use this paper in ordinary room light. To make photograms place objects on the paper, then expose to bright light, such as sunlight. It will develop into a dark rich purple color on its own. If you wish to fix your photos use ordinary fixer (vinegar works well for fixing if you don't have photographic fixer) to develop a deep brown color. The prints should be washed and then dried. Negatives can be printed but this paper is not suitable for making enlargements.

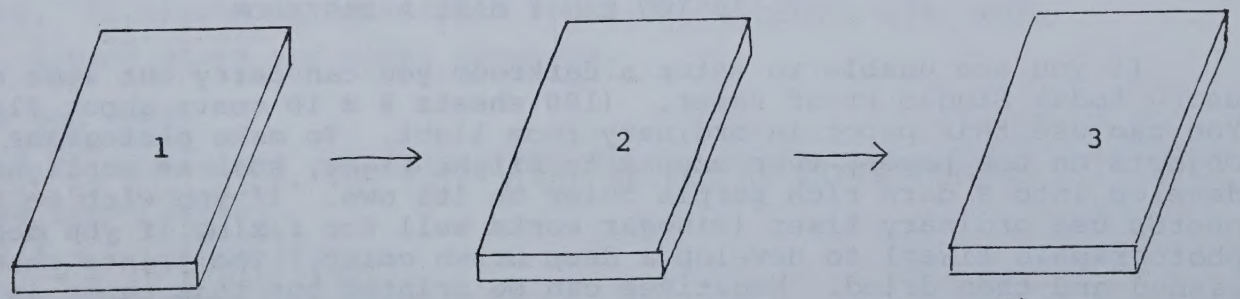
Pre-evaluation: (see Appendix A for Pre-evaluation Form)

The pre-evaluation is not meant to be a test. Rather, it is an information gathering device to determine which students have had experience in photography. Even if they have taken pictures with an instamatic or polaroid camera, the work of this unit will still be interesting to them. The questionnaire serves to find out which students have had experience with cameras. It helps you to pick teaching assistants. It requires short answers and diagrams. It is a useful device providing feedback.

Photograms

Photography without cameras is exciting because it is so simple. The creative possibilities are enormous. Here's how!

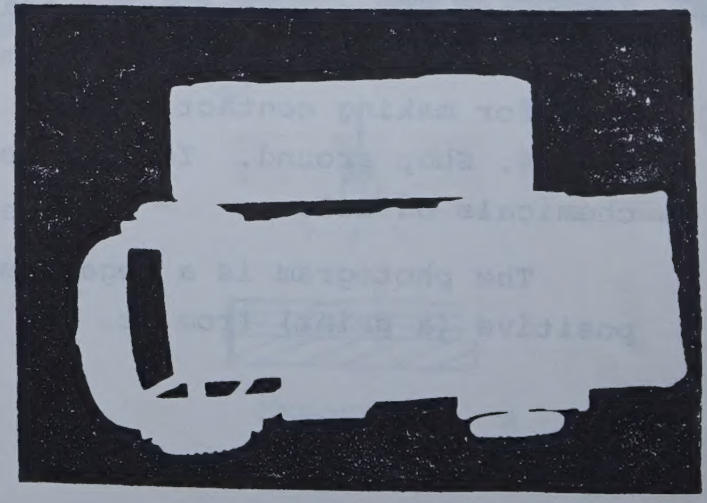
1. Have the darkroom ready; chemicals in trays nicely arranged in order on the table.

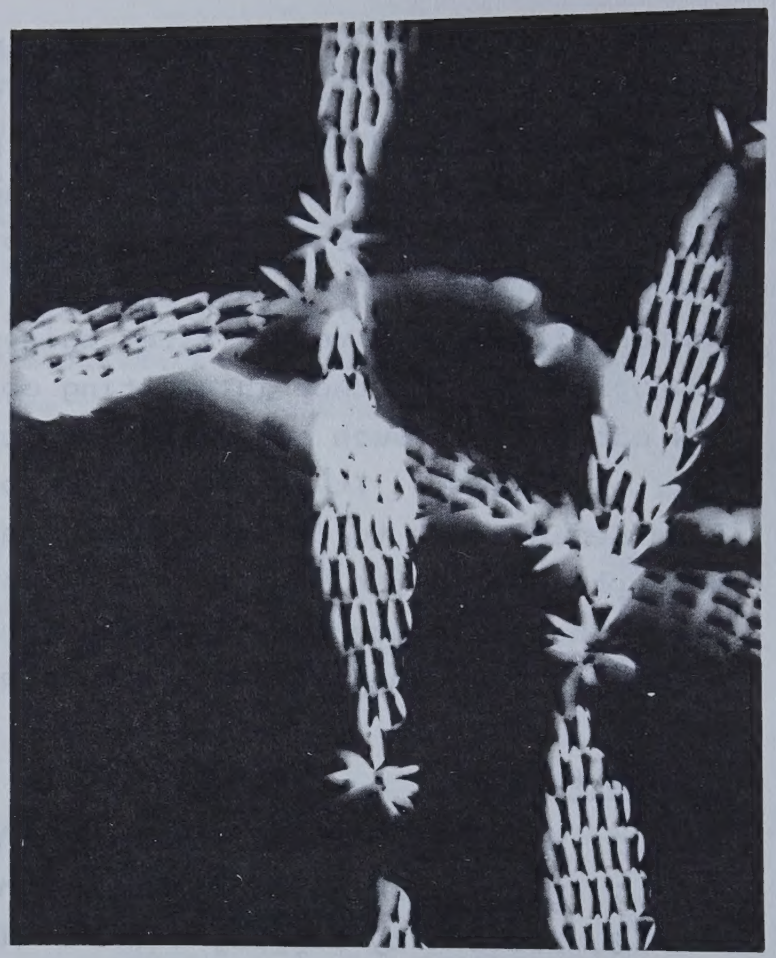


2. Turn on the red lights and turn off the room lights. Give each student a piece of photo paper. Ask them to clean out their pockets. Place the objects on the shiny side of the photo paper on the table. When they are ready, expose the paper by turning the room lights on for about five seconds. Take turns to develop the pictures, wash and fix them. When all the photos are in the fixer, you can turn the lights on. Voila, instant photos without a camera! After this experience, students will want to make photographs with other interesting objects in the room and you can have a few odd objects such as nuts and bolts, feathers, chains, twigs, and leaves, etc., available. It is preferable to get them started as above, then let them decide what to do with a good supply of objects on hand. You can make more photograms the next session because by then they will have gathered a few things to place on the photo papers. They will be so proud of their creations that they will want to take them home.

Things to try:

1. Using opaque and transparent objects.
2. Experimenting with shadows and overlapping of materials of objects.
3. Writing by dipping a brush with chemicals, e.g. write or paint with developer before exposure or use fixer to paint before exposure.
4. Some may try fixing the paper before exposing or the combination of both.
5. Experimenting with exposure timing.
6. Using more than one sheet of paper to make composite pictures.





Materials Required:

1. Paper developer - Kodak Dektol to make 1/2 gallon solution. Dilution, 1 part of stock solution to 2 parts of water, develop for 1 minute. Use about 16 oz. diluted solution in a tray and keep the used solution in a bottle for re-use at the next session. If it is not effective, i.e. takes longer than 1 minute to develop picture, then discard the used developer.

2. Paper fixer - Kodak fixer to make 1/2 gallon. Follow directions and keep solution for re-use. Fix for 5 to 10 minutes.

3. Photo paper - Kodak Velox F2, single weight, 2 1/2 x 3 1/2 in., 100 sheets.

4. No need to use stop bath between developer and fixer - just use a tray of water.

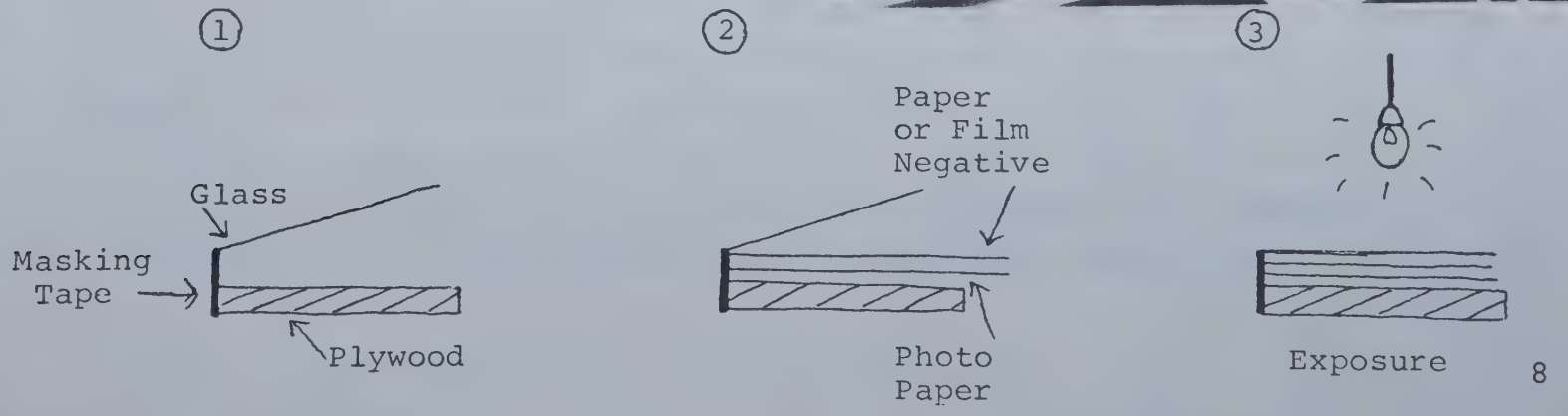
5. The same set up and chemicals can be used for making contact prints.

6. Shop around. You may be able to get some out of date photo paper or chemicals on sale.

The photogram is a negative. The next logical step would be to make a positive (a print) from it.

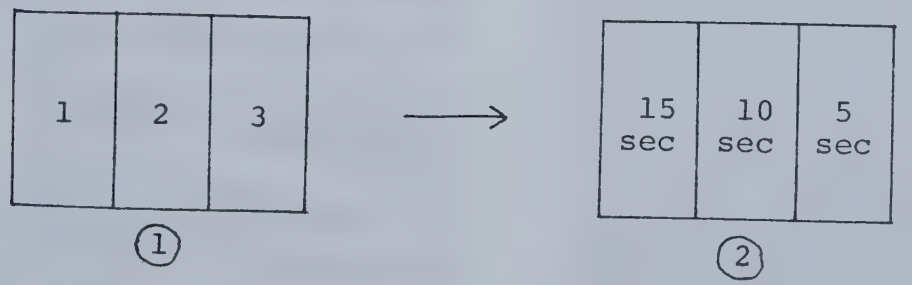
Contact Prints

A contact print is made by placing a negative (a photogram or a photographic negative) in contact with a sheet of photographic paper and exposing the photo paper. You will need the same darkroom set up as you used to make photograms with the addition of a contact printer. You can buy one for about $15.00 or make a few for the class by using a glass plate about 8" x 10" placed on top of a piece of plywood about the same size. File off the sharp edges of the glass and use masking tape to tape one side of the plate onto the plywood to form a hinge.



The length of exposure for making a print is different from the exposure used to make the original photogram. Using the photogram as a negative, the exposure has to be accurate enough to make a reasonable picture in tones of black, white, and gray. You should check to make sure that both the negative (photogram) and the photo paper have the shiny side up. The photogram, as a paper negative, will require more exposure than a film negative. In order to get correct exposures, you can do a test by making a print with several different exposure times. Try at least three different intervals.

A Test Strip



Use a piece of cardboard to cover up areas 2 and 3 and expose area 1 for 5 seconds, then move card to expose area 1 and 2 for 5 seconds followed by exposing all three areas for 5 seconds. You will get a photograph with three different exposures - area 1 being exposed 3 times will be the darkest area. This way you made a three step test with 5 second intervals. Depending on the distance from the light to the paper, the exposures should be longer or shorter. By inspection you will be able to determine the correct exposure for a particular negative or negatives of similar density. Some

students may bring their own black and white negatives and some will bring color negatives, which have a brown color tint (these last will take about twice to three times the exposure of the black and white negatives). An "interval timer" can be used but it is easier to estimate by counting aloud, e.g. 1 thousand 1, 1 thousand 2, etc.. The same technique of estimating time will be useful for making contact proof sheets and enlargements as well as exposure control on the pinhole camera.

Darkroom Chemistry

The idea is to provide students with practical experience then proceed to explain photographic chemistry at their level. By now they have touched, smelled and possibly tasted the chemicals. Their attention should be directed to all cautionary information on the chemicals. The basics of the chemical reactions in relation to making up solutions, the chemical make up of the solutions, and the emulsion on the photo paper and the film negative may be explained at different intervals. The concept of chemical change by exposure, development and fixing can be introduced at strategic moments. Concentration of solutions and temperature control should be emphasized. More information may be developed in class research projects. A group of more capable students may undertake such a task to gather more information for the rest of the class.

Pinhole Photography

So far we have practiced photography without cameras, but, a simple camera is easy to make. The pinhole camera is not a new concept. Many

science textbooks mention it. The question is how we can adapt it to work for us like real cameras? (B.C.T.F. has published an excellent lesson aid by Gordon R. Gore on Pinhole Photography. This pamphlet will provide you with very useful information.)

Basically, a pinhole camera is a light tight box with a pinhole in one end. A piece of a film is placed inside the box on the end opposite the pinhole. By covering and opening this pinhole, light is allowed to reach the film forming an image which can be developed. The camera can be a cardboard box, a wooden box, or a tin can.

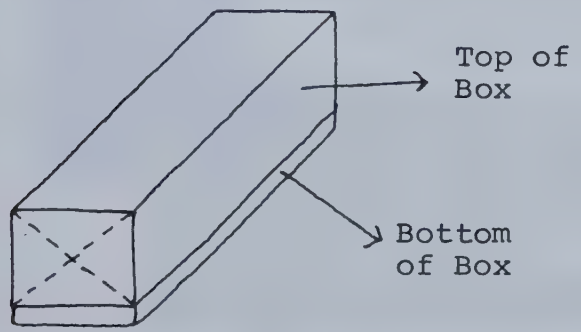
Materials for Making Pinhole Cameras:

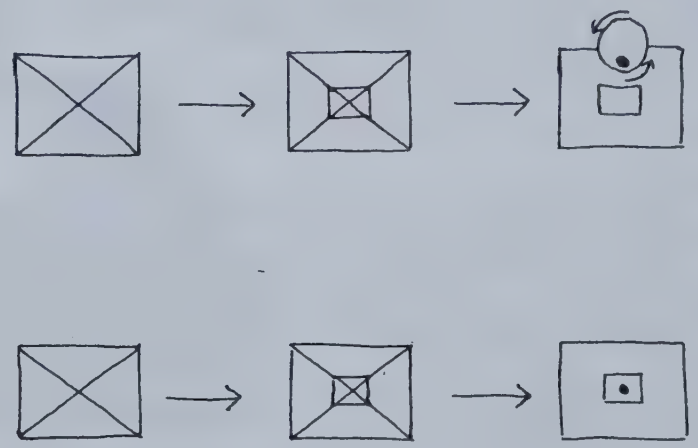
Pin, tinfoil, scissors, sharp knife, stapler, metal tags, masking tape, dull black paint, a few cardboard boxes or sheets of cardboard.

Ask the students to bring cardboard boxes of all sizes to class (e.g. toy boxes, chocolate boxes, or any type of square or rectangular good sturdy boxes). Shoe boxes are not very satisfactory because the lid is shallow and allows in light. (It can be taped down with electricians tape but this is messy and inconvenient.) A camera which can be easily loaded allowing

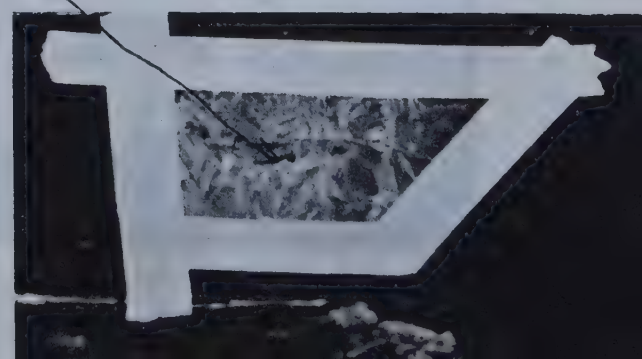
many quick and easy exposures will be the most successful. If the students' boxes are not suitable they can use one you have provided or they can construct one with cardboard and masking tape. In this case, a small box of 2" x 3" will be a good size to work with. You can encourage students to try out boxes of different sizes.

Construction of a Pinhole Camera

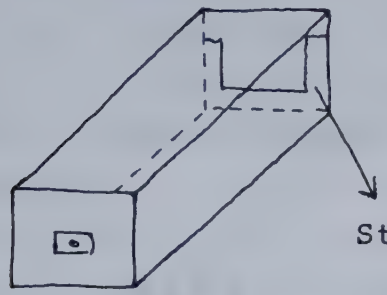




Locate the centre of the boxtop front. Cut an opening and attach a piece of thick card with a metal brad so that it can be rotated to open or shut the pinhole. Then locate the centre of the box-bottom front, cut an opening in the same position as on the boxtop front.
Tape a piece of tinfoil over it. Punch a neat pinhole on the tinfoil at its centre.



Bottom Half of Box



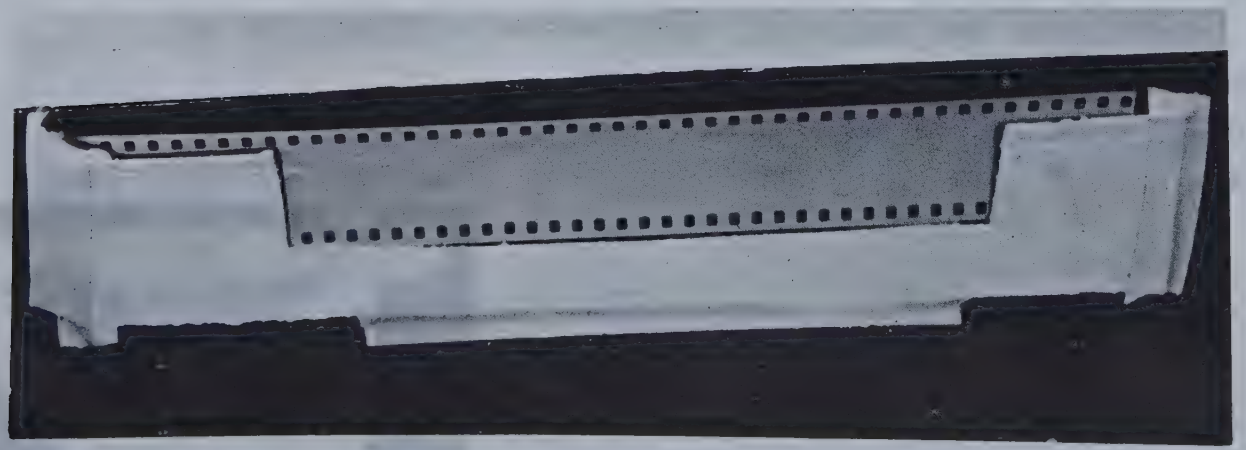
Staple Film Holder on Box

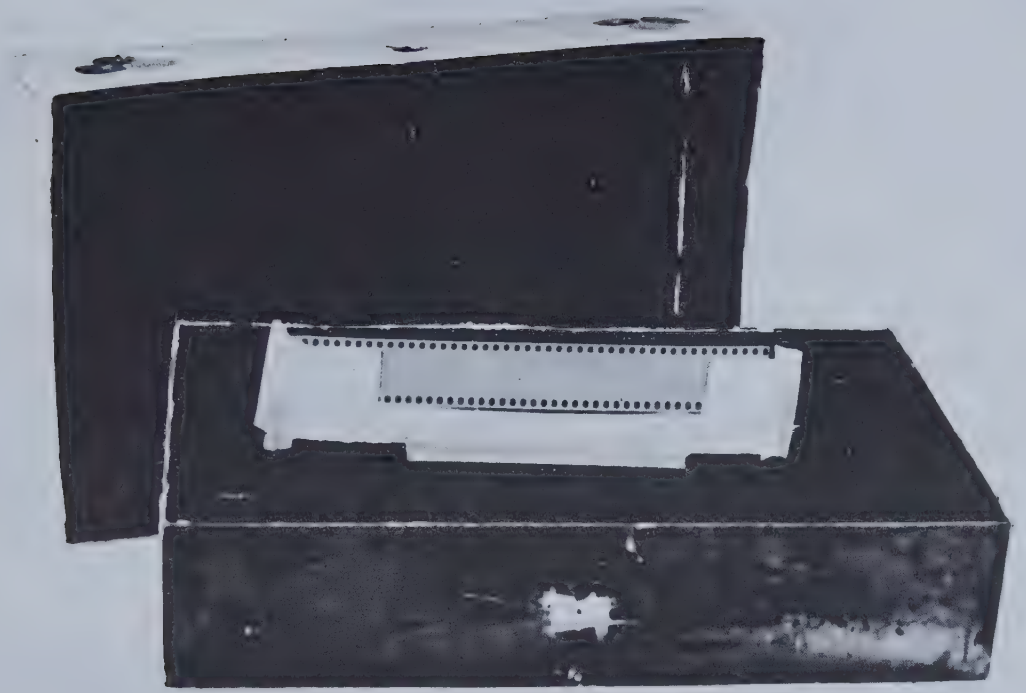
Cut Cardboard as Film Holder

Cut another piece of cardboard to fit into the holder, this will serve as a yardstick for cutting film to fit this camera.

Cardboard as Yardstick for Cutting Film

In the box-bottom at the opposite end from the pinhole, construct a film holder with a piece of cardboard. Cut another piece of cardboard to fit into the holder, this will serve as a yardstick for cutting film to fit this.

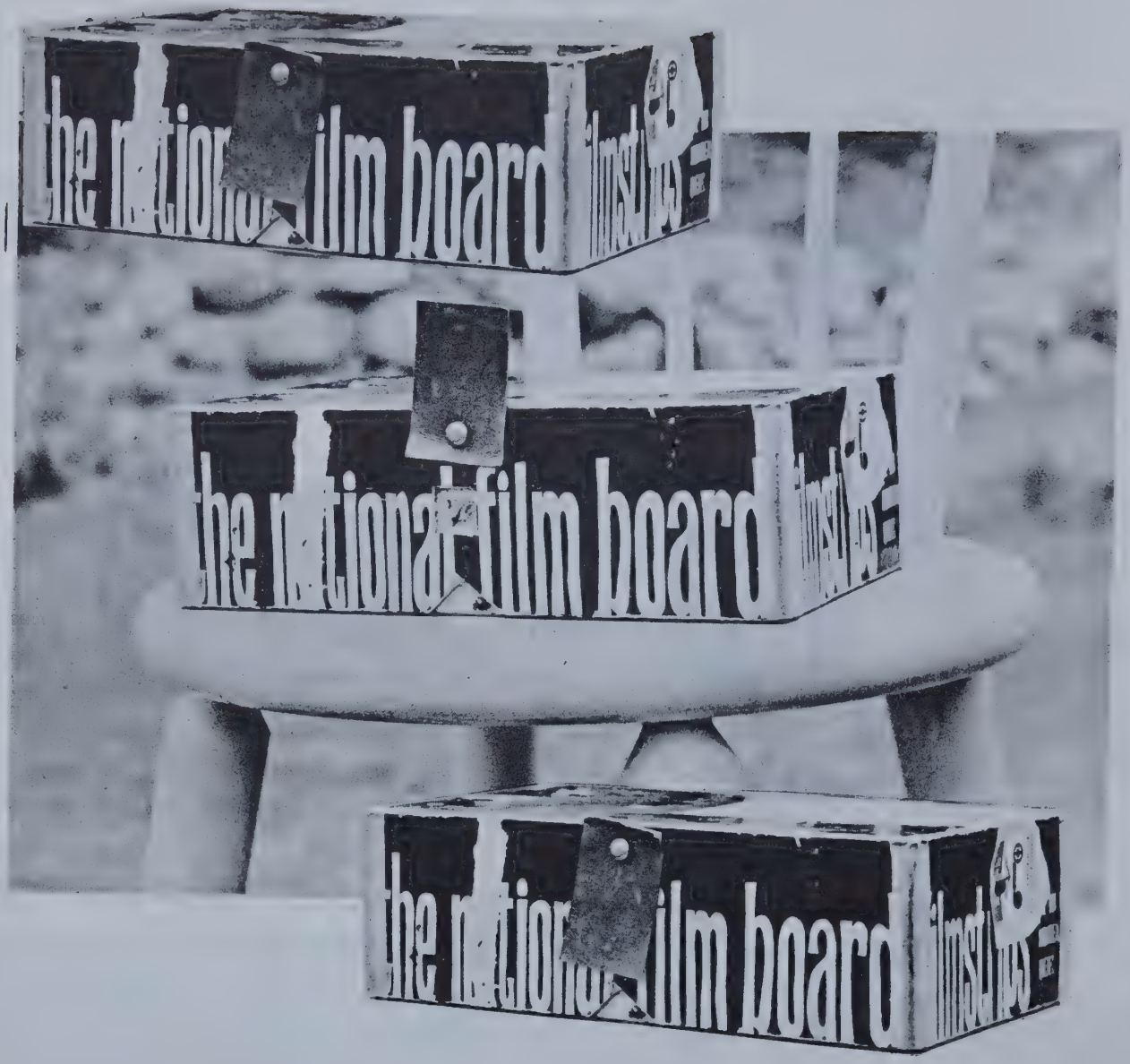




Trade Secrets:

An excellent film for the pinhole camera is Kodak's Fine Grain Positive Film designed for copying and for making positive transparencies from 35 mm camera negatives. Open only in your photographic darkroom. The film comes in a 100 ft. roll in a can. It has a very low exposure index (allowing a long exposure) is white in color and behaves like photographic paper, and you can work under a safe light. You can develop this film using Kodak Dektol stock solution which you already have. Develop, wash, and fix the film as with the contact prints or photograms in your darkroom. The whole class can cut the film to size according to their yardstick and load their cameras in the darkroom, but be sure to have the emulsion side facing the front. The film appears white under red light and it is difficult to tell which side has the emulsion. The rule of the thumb is to see which way the film curls because it comes as a big roll with the emulsion facing inward. The side curved in has the emulsion. Students can develop the film by watching the image appear under the safe light.

Exposure:

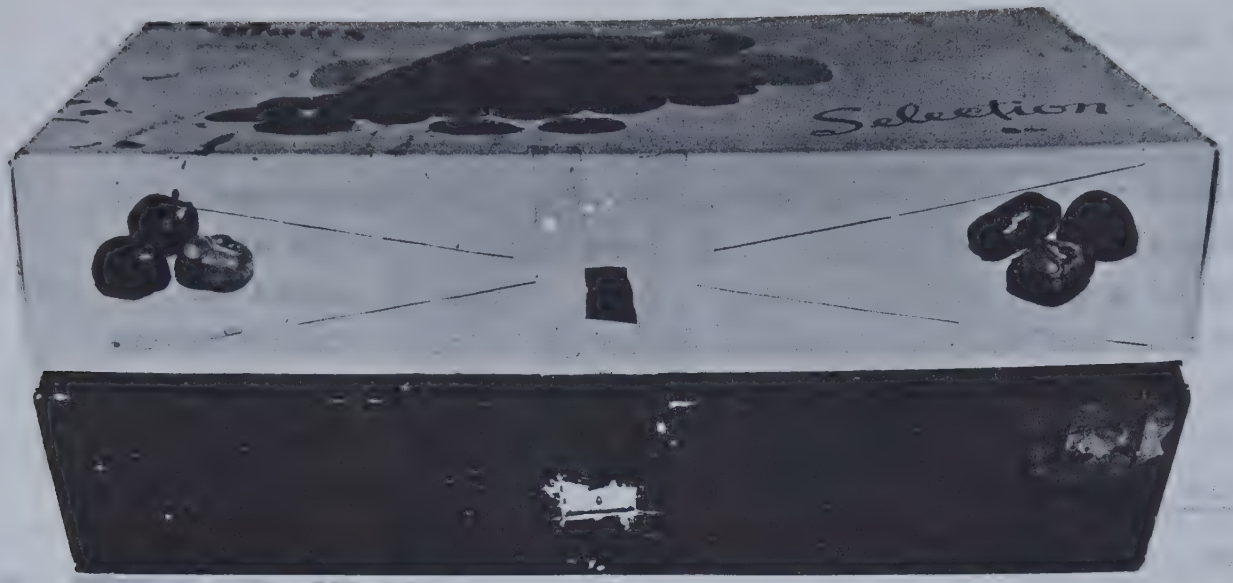


On bright sunny days, the exposure will range from 2 to 10 seconds. It may take minutes on a dull rainy day. Experiment to find out the correct exposure - 5 seconds will be a good start. Place your camera on a chair or some support instead of holding it by hand, otherwise the picture will be very blurry. For the same reason, make sure that the camera is pointed to a stationary object such as buildings, automobiles, or other still bodies. Exposure can be controlled by opening and closing the lens cover carefully and timing by counting in seconds. When the students have made their exposures, they can return to the darkroom to develop the film in concentrated (undiluted) developer for about 1 minute. Wash. Fix for about 5 minutes. The whole process can be repeated many times,

keeping records of exposure and subjects for comparison. Some students will always get good negatives; others may have to try many times. They may have cameras with light leaks, too large or too small pin holes or they may be shifting their cameras or photographing moving objects. The negatives will tell. The class can analyse the features of a good pinhole camera and the good working habits of a good pinhole photographer. Emphasis should be placed on experimenting and sharing information on technique. Each student must go through the process of making and using his own camera.

Variation on Pinhole Cameras:

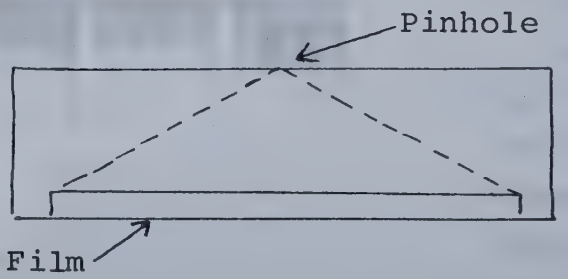
The next stage can be devoted to redesigning of cameras. From the experience of my own class, here are a few ideas we can share. For example, we found that wide angle cameras (short boxes) are easier to use. Telephoto cameras (long boxes) are more difficult to use. You can build cameras with



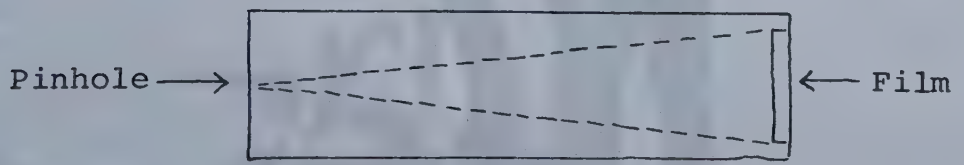
adjustable film planes for experimenting.

1. WIDE ANGLE CAMERA (USES A LOT OF FILM):

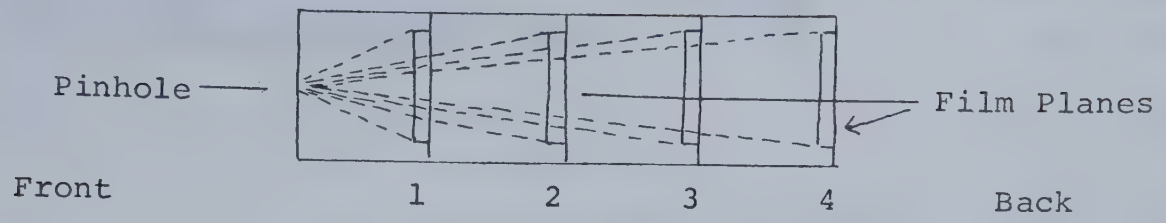
(Top View)



2. A TELEPHOTO CAMERA WHICH REQUIRES LONGER EXPOSURE AND VERY STEADY SUPPORT:

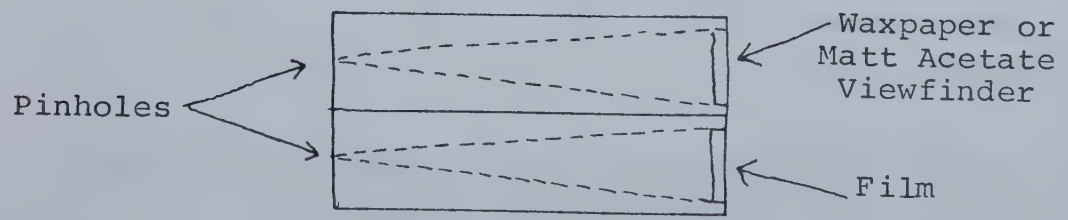


3. A CAMERA WITH VARIABLE FILM PLANES:



This is a good camera for experimenting with exposure and image size. Note the variation you can get from a wide shot to a narrower shot. As you move the film from position 1 to 4 an increase in exposure is required. Some positions may be out of focus, but generally a pinhole camera has good depth of field.

4. TWIN HOLE CAMERA:



Two boxes of the same size may be used to make a camera with a viewfinder on top. This can lead to the discussion of parallex problems. What they learn can be related to standard cameras with real telephoto and wide angle lenses and the parallex problem with range finder and twin lens reflex cameras.

Believe me, a good chunk of science can be taught by this light tight cardboard box.

PINHOLE EXPOSURE GUIDE	OUTDOORS: 5 to 15 seconds
	CLASSROOM: 5 to 10 minutes

Results will depend on:

1. Size of the hole - it should be a neat pinhole. If too small it will produce an image with a fuzzy edge. If it is too large it will produce a blurred or out of focus picture.

2. Type of film - regular 35 mm black and white film or photo paper may be used but will be difficult to work with because of the exposure necessary. We recommend Kodak fine grain positive film.

3. Available light - bright sunny days will produce good negatives.

4. Distance of pinhole to film - works fine from 1" to 6". The smaller cameras generally give better results and have shorter exposures and few light leakage problems. Small, wide angle cameras tend to give best results.

5. Type of subject photographed - preferrably stationary. Buildings, automobiles, and other contrasty (light and dark) subjects will produce the best printable negatives.

6. Developer - for the fine grain positive film, Dektol stock solution tends to give the best results. When the developer is exhausted, a weak image on the film will result and even that will fade during fixing. Make sure that the film is developed long enough to get a good image before fixing. Using other film or paper may slow down your experiments and cause control problems. By using

fine grain positive film, the students can see what they are doing. This provides instant feedback to them, and is inexpensive.

The Craft of Photography

If your class has successfully mastered the art of pinhole photography the students are probably ready for some experience with standard cameras. You should be able to find a way to borrow or purchase a few cameras. Perhaps by now you have the use of the school darkroom, which is usually equipped with an enlarger.

Additional equipment and materials will be required. Besides cameras, you need film developing tanks, changing bags, enlargers, print dryers and chemicals for processing.

For a class of thirty you should have:

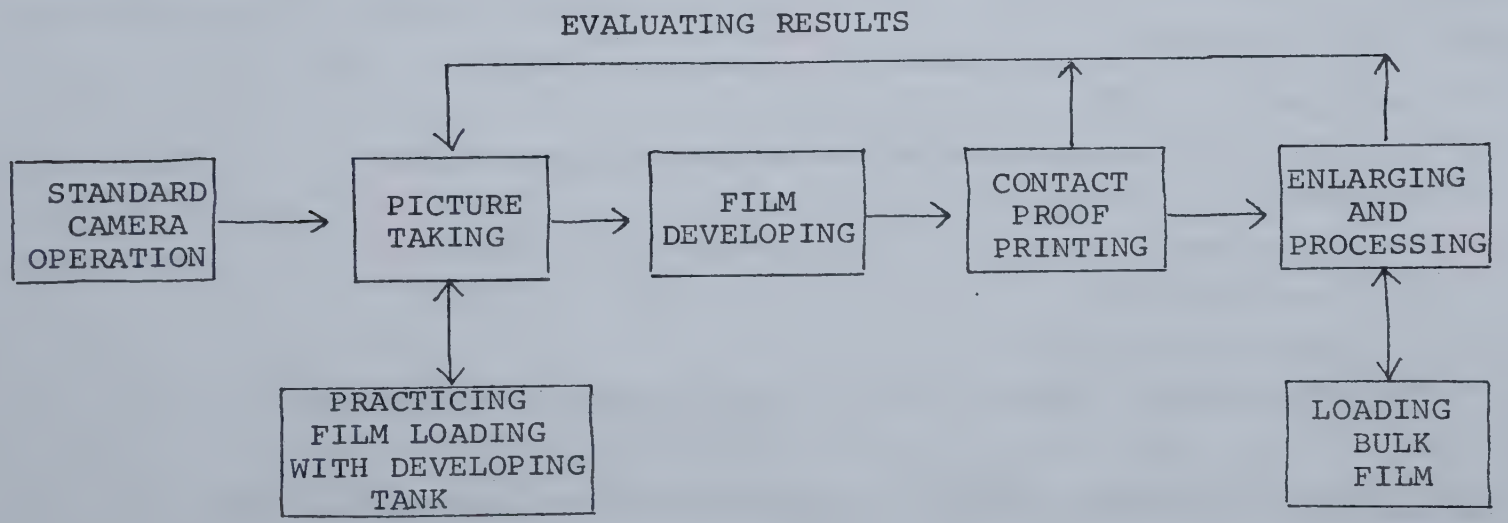
1. At least one camera for every two students.
2. Five developing tanks.
3. Five change bags.
4. Two enlargers.
5. One print dryer.
6. Processing chemicals should now be made up in one gallon quantities.

BUT: If you only have half the above quantities the activity will still be worth trying!

We have found that groups of five students works well. First, demonstrate how to hold and operate the cameras. Then give each group of 5, to begin with, a roll of film and a camera. With very specific instructions on

exposure setting, each student is asked to take pictures. Then ask each group to experiment freely with 10 or more exposures. They then develop the film just by following instructions, followed by making their own contact print with their negatives. It is important for the students to experience some success with their first roll of film. The basics of photography can be given after they gain some practical experience. More advanced techniques and gadgets can be introduced at the appropriate time to stimulate further interest.

This part of the course may be illustrated by the following flow chart of activities:



Standard Camera Operation

Have enough cameras and practice film available. Students may be divided up into groups of up to 5 to share one camera depending on the number of cameras available. Some students may be able to bring their own cameras or borrow one to use.

Taking pictures means allowing light to get into the camera to expose the film. To control the amount of light we have the device of the aperture of different sizes and a shutter that opens and shuts for a time interval. The combination of the two devices gives exposure control. The film is sensitive to light and the manufacturers have labelled the film with an ASA number which tells us how sensitive the film is to light. For our purpose a medium speed black and white film - Ilford FP4 ASA125, 20 exposures can be used. Show the students how to set the f-stops ranging from 2.8 up to the smallest, usually f16. Demonstrate by opening the back of the camera for the students to see the change in the size of the aperture as you move up or down the scale. Also demonstrate the different shutter speeds in this manner. An exposed but undeveloped film may be loaded in the camera. With the back of the camera open you can demonstrate the inverted image on the gray film, if you point the camera to a window. Also demonstrate how to advance the film, rewinding and unloading the camera. Don't forget to show the students how to focus or estimate and set the distance for the lens to take a sharp picture. Particular attention may be paid to the way the camera can be held steadily when taking pictures. (Feet apart and elbows firmly against the body.)

Students should be encouraged to become familiar with the different parts

of the camera and their effect on the picture.

Picture Taking

If you have enough film each student should have a roll. Ilford FP4 20 exp. 35 mm black and white film. Each student should have the experience of opening the package and reading the instructions. Particular attention may be drawn to the exposure guide. (Ilford 35 mm film is chosen because of the re-usable cartridge for loading bulk film later in the unit.)

While one group of students is taking pictures with cameras another group of students who are waiting may be occupied by learning to load a roll of practice film into a developing tank using a changing bag. Two of my students developed a good way of tackling the task. One boy had difficulties with loading the film onto the developing tank reel. His companion helped by demonstrating the loading technique step by step with a film and tank right in front of him to give him all the necessary visual help.

Records of exposure should be kept. Printed forms may be designed to help the class to record their exposures systematically. Students should follow the exposure guide that comes with the film. Show them how to bracket exposures. (Bracketing exposures means taking a picture at the indicated f-stop and then at one f-stop above and one f-stop below using the same shutter speed and subject.)

For example, if it is a dull day, according to the exposure guide you shoot at f5.6 with shutter speed 1/125. Take one shot at f5.6 and then one shot at f4 followed by another one at f8 at the same speed and same subject. Since black and white film has better lattitude you may bracket two steps

thus taking five pictures altogether -

f5.6 - First exposure according to guide.

f4, f3.5 - Second and third exposure. Exposure increased one stop at a time.

f8, f11 - Fourth and fifth exposure. Exposure reduced one stop at a time.

Generally, if it is a bright sunny day with blue sky and distinct shadows f16 and 1/125 will always give a good picture outdoors. If the sky is overcast (no shadows) set the aperture at f8 and if it is a dull day set the aperture at f5.6 or 4 accordingly but keeping the same shutter speed (1/125). It is important to change only one variable at a time.

After the students have taken 5 exposures as described above they can try an exercise on the effect of changing shutter speeds. The aperture remains constant. For example, under the same lighting conditions as above, set the f-stop at f5.6 and expose the film at: 1/125, 1/60, 1/30, 1/250, 1/500. For the last ten exposures on the film, students are encouraged to experiment freely but not wastefully.

Film Developing

This process includes the following steps:

1. Unloading the camera by winding the film back into the cartridge and taking it out of the camera. Be sure that the students have mastered the process of loading a tank with practice film before loading with exposed film.

2. Loading the developing tank - put all the parts of the developing tank into the changing bag. The cartridge is opened inside the bag and the

exposed film is loaded onto the take up reel of the tank. Put the cover on the tank before removing it from the changing bag for processing.

3. Developing the film - have enough film developer (Kodak D76) ready at 68°F. or room temperature to fill the tank. Fill the tank with tap water at about the same temperature to set the film. Pour the water out. Have a timer or watch ready. Then pour the film developer into the tank as quickly as practical. Agitate by turning the stirrer for about ten seconds. Then agitate for 10 seconds every minute until the set time is up (seven minutes for FP4). We had been very successful with the combination of Kodak D76 film developer and FP4 Ilford film. The chemicals suggested by the manufacturer may be used if you wish. Sometimes it is better to use a 1:1 diluted D76 solution and develop the roll for 8 minutes and discard the solution to avoid contamination and the complication of adjusting developing time as the solution goes weaker and weaker after each roll is developed. D76 seems to work reasonably well for our purpose and can be kept and used for a long time (say one month) if you use a dark colored container such as a brown bottle.

4. Fix the film for 10 minutes with agitation. Wash and hang it up to dry with proper film clips so that the film will not curl.

Contact Proof Prints

When the film is dried, it can be cut into lengths of 5 or 6 frames. Contact proof prints can be made by placing negatives on top of photo paper (Ilfobrom #2 grade) and expose for about 2-5 minutes with room light. You may have to test to find a good exposure. Use the contact printer you made or acquired early in the unit.

Some frames on the negatives may not show up well on the print because they are too dark or too light. As long as there is a clear image, faults can be compensated by adjusting exposure during enlargement and processing. The prints are very small so each frame should be examined with a magnifying glass to avoid wasting time and materials enlarging blurry negatives.

At this stage, the students should have learned how to obtain an acceptable exposure. Composition and other fine techniques may be learned later. Students should take more pictures and repeat the process of developing and contact printing. Negatives and contact sheets should be marked and stored together.

Loading Bulk Film

As the students use more and more film, cost will become an important factor. Generally the first two rolls of films should be standard rolls of 20 exposures. By the time the students want to shoot a third roll they should learn to load their own from bulk film.

Loading bulk film (50 ft. or 100 ft.) into re-usable cartridges can be done by using a bulk film loader (cost $15 to $25) or by hand with a changing bag. Bulk film loaders can cause scratches on the film but make loading easy. Doing it by hand may leave finger marks on the film if not done carefully. Also, from time to time students forget to put the bulk roll back into the can, exposing the whole roll when they open the change bag. So rolling by hand can be expensive. To roll by hand: inside the bag, stretch out a length of film the width of the bag (good for about 10 to 15 exposures) cut and tape it to the spool and wind it into the cartridge carefully. The leader

can be trimmed to facilitate easy loading on the camera. In fact, for some students it is a very difficult task but it is a worthwhile experience.

Evaluating Results

A careful study of the contact sheet with a magnifying glass will reveal some pictures with fuzziness usually caused by camera movement or improper focus. Enlargement will only enlarge and bring out the errors. Some exposure errors can be compensated by enlarging and processing. The final cropping can be marked on the contact sheet to remind the person who will be doing the enlarging what should be left out.

At this stage, different ways of holding the camera steady may be re-emphasized. How to choose a suitable background and lighting may be discussed using examples of good and poor photos. Composition may be discussed but rigid rules should not be made since you wish to encourage creativity.

Enlarging and Processing

Making good enlargements can be a complicated art. Pick out some good sharp negatives and enlarge them to the size of 5 x 7 or 8 x 10 with simple straight forward technique on enlarging paper (Ilfobrom #2). Exposure testing should be done carefully. Try to standardize at one enlarger aperture, say f8. A three step test strip should be used. Thin strips of photo paper may be cut for this purpose. Since the students have been trained to estimate time by counting when doing the photograms, the pinhole exposures and the contact sheets, they should not have a problem here. A cheap "second timer" may be added to the equipment list to increase the reliability of the

exposure time.

The exposed paper may be developed in Kodak Dektol paper developer 1:2 solution for 1 to 1 1/2 minutes when the darkest area turns deep black on the print. If the print turns dark in less than 1 minute it means that it is over exposed. If the print takes longer than 1 1/2 minutes to turn dark it means that it is under exposed.

The print can be fixed for 5 minutes in two fixing baths, (10 min. altogether). If the prints turn yellow, prepare a new solution to replace the second bath and move the old second bath to the first position. Wash and wipe off excess water from the print. The well washed prints can be dried by a photographic blotter book or an electric dryer.

Depending on the density of the negative, different grades of photo papers may be used to compensate for errors in exposure on the film. If negatives of exposures done indoors appear to be too thin, try using paper with a higher number (3, 4 or 5). If negatives tend to be too contrasty (having strong black and white areas) try using lower grade papers (1 and 2). Some experimenting can be done by extending the development time. Indoor exposures may be compensated for by longer development of the negatives. For FP4 at ASA125, outdoor exposures at f16 and 1/125 sec., develop in D76, full strength for 7 minutes. When FP4 is exposed indoors, say in the classroom at f2.8 and 1/125 sec. you may have to develop for 12 minutes in order to push the film speed to ASA 200 to get printable negatives on no. 2 grade paper.

Refinements and gadgets can be introduced as the course progresses. Working within limits of this does not necessarily mean poor quality work. In fact the aim of this course is to use basic inexpensive equipment and

materials to achieve maximum results and generate active learning on the student's part.

Integrating into other areas of learning

Owing to the abundance of visual media, the students are quite critical of their own work. As long as no great technical faults are committed all pictures should be acceptable. They are meaningful to the young photographers. We usually let the students enlarge about 4 or 5 good photographs of their choice say 5 x 7, and use them as their own standard. They can take, develop and print more pictures as long as they try to maintain or improve their own standards. Different types of photo assignments may be given ranging from record keeping shots of school activities to taking pictures to express opinions or feelings and moods.

Field trips to commercial photo labs or more elaborate darkrooms may be arranged for the class. Photo exhibitions may be viewed and followed by discussions. More technical sessions given by experienced photographers and resource persons may be brought in. Once the students have mastered the basics of photography they should be encouraged to apply what they learned to areas of language arts, social studies, science and environmental awareness in their projects or research.

This may be only the beginning of photography for some students. Who knows?

Equipment and materials suggestions when working with cameras:

Cameras: 35 mm single lens reflex ZENIT (about $67) or PRACTICA (about $90).

Film - Ilford FP4 ASA125 medium speed film or HP4 ASA400.
Exposure Guide - provided by the manufacturer.
Film Developer - Kodak D76.
Enlarging Photo Paper - Ilfobrom No. 2 grade single weight, glossy 5 x 7 or 8 x 10.
Paper Developer - Kodak Dektol developer.
Enlarger - AXOMAT (about $112) or ZENIT (about $45).

Reference

Cooke, Robert W.	Designing With Light	
Haffer, Virna	Making Photograms	Amphoto Books Hasting House Publishers New York
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Gore, Gordon R.	Pinhole Photography	B.C.T.F. Lesson Aids Sept. 1972
Fox, Stuart	Photography Using Only Available Light	
		Cornerstone Library New York
Croy, O. R.	The Complete Art of Printing & Enlarging	
		The Local Press London & New York
Liderman, Earl W.	Invitation to Vision	Ideas & Imaginations for Art, Wm. C. Brown Co. Publishers

APPENDIX A

1. Have you seen a pinhole camera before?

   Yes_____

   No _____

2. If yes, describe in your own words what a pinhole camera looks like.

3. Do you think pinhole cameras can take real pictures?

4. What do you see by letting light go through the pinhole into a tin can and watching it through a piece of wax paper or ground glass from the back?

5. In what way does light travel? Do a drawing to show.

6. An image is the picture formed by light patterns.

   Yes_____

   No _____

7. Can you expose the film to get an image?

Yes_____

No _____

8. What do you call the chemical that brings up the image on the exposed film?

Fixer _____

or Developer_____

or Stop Bath_____

9. What does the fixer do?

Brings up the picture_____

Prevents the picture from any further change by light_____

Makes the picture look good_____

10. Can you tell the difference between the developer and fixer by:

(i) smelling_____

(ii) touching_____

Which one gives a soapy feeling?

Developer_____

or Fixer _____

11. Are the chemicals poisonous?

Do you have something to say about handling chemicals?

12. Would you like to learn to:

take pictures with cameras_____

develop pictures _____

enlarge your own pictures _____

II.

1. What do you get when you expose a piece of film by a pinhole camera?

a positive_____

or a negative_____

What is the difference between a negative and a positive?

2. When you are using the pinhole camera how do you control exposure?

3. When you are using a 35 mm camera how do you control exposure?

4. What do the numbers on a camera 2.8, 4, 5.6, 8, 11, 16, stand for?

Distance in feet _____

Aperture (lens opening)_____

Shutter speed _____

5. On the camera, what do the numbers and letter B, 15, 30, 60, 125, stand for?

Distance in metres _____
Aperture (lens opening) _____
Shutter Speed _____

6. What does B mean to you?

7. Do you know: (a) How many minutes do you develop a film by using a developing tank and a film developer? _____
(b) How long do you fix the film? _____

8. If you are going to buy some photographic chemicals for your own use at home, what do you get?

9. What temperature should the chemicals be for developing film or paper?

10. How many different types of films have we been using? _____
Name them:

11. How many different types of photo papers have we been using?_____

Name them:

12. In terms of feet and inches, how long is a metre?_____

APPENDIX B

Photography Record Sheet

EXPOSURE NUMBER	SHUTTER SPEED	LENS OPENING	DESCRIPTION OF LIGHTING	RESULTS
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
EXAMPLE				
1	1/125	11	OUTSIDE-OVERCAST DAY	EXCELLENT
2	1/125	2.8	OUTSIDE-BRIGHT DAY	OVEREXPOSED

TR 161 T87 1973 C-2
TSANG ERIC 1935-
CLASSROOM CAMERAS/

39323873 CURR

000005336599

TR 161 T87 1973 C. 2
Tsang, Eric, 1935-
Classroom cameras /

39323873 CURR